ALNOR®

BALOMETER®
AIR BALANCING INSTRUMENT
OWNER'S MANUAL

CONTROLLED DOCUMENT

ALN

Procedure #:

Part # : 116-158-000 **Code : OWN**

Model # : BALOMETER

Rev : 13 **Print date : 1/1/91**

WARNING: Internal Document !

Check in the library at the end of each shift

SAFETY NOTICE

When using the Balometer to check air flow at ceiling diffusers, make certain that you can safely raise and hold the unit while making measurements, especially when working on a ladder.

Observe all necessary precautions so that the unit does not become caught in moving machinery.

The Balometer is not designed for gas mixtures other than air. Any use with corrosive or other dangerous or explosive gas mixtures is not recommended, and is at the user's risk.

CAUTION

Due to its size and shape, care should be taken when carrying the assembled instrument from place to place so that it does not accidentally bump into people or objects.

Special nylon material is used to manufacture the Balometer hoods because of its impermeability and toughness. Precautions should be used however, so that it is not ripped by accidental contact with sharp objects.

When the instrument is stored or otherwise not being used to take readings, be certain to protect the meter movement by switching the range selector to the OFF position.

The air flow sensing manifold can be damaged if subjected to excessive stress. It is not repairable. Any air flow other than through the calibrated sensing holes (even hairline cracks) will affect instrument accuracy. Special manifold mounting springs are designed to cushion the assembly and allow for some deformation of the base without affecting accuracy. These springs should not be removed or altered in any way.

WARRANTY

Your warranty information and reply card are enclosed elsewhere in this package. After locating this material, please return the reply card and retain the Certificate of Calibration.

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Skokie, Illinois 60077

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NOTES

GENERAL DESCRIPTION

The Alnor Balometer is designed to assist the user in rapid and accurate measurements of air distribution in heating, ventilating, and air conditioning systems. The Balometer directly reads average air flow rate, either intake or outflow, at ceiling, wall or floor diffusers. This eliminates the need for multi-point traverses, the resulting calculations and use of K factors.

In use, air to be measured is directed past a manifold which senses flow at multiple points spread across a carefully sized area. The manifold is designed so that the air volume is sensed at either supply or return diffusers with equal accuracy.

The manifold is connected through the range selector to an Alnor Velometer which can be provided with scales for English measurement units of cubic feet per minute (CFM) or either of two metric scales, cubic meters per hour (cmh) or liters per second (1/s), and is capable of reading flows up to 2000 CFM (3400 cmh, 950 1/s). This time-proven Velometer is the heart of the Balometer measuring system.

For increased accuracy and convenience, a single knob direction and range selecting unit allows control of the Balometer for either supply or return diffusers, on ranges of 100-500, 400-1000, and 800-2000 CFM. (170-850, 700-1700, and 1400-3400 cmh; 50 to 240, 200 to 475, and 400 to 950 1/s).

A LoFlow adapter is also included with each Balometer for accuracy in balancing modern air sysems which incorporate low volume diffusers. When used with the most sensitive range selector setting it provides a highly accurate measurement range up to 50 to 250 CFM (400 cmh, 120 l/s).

For increased flexibility the unit can be supplied with up to five sizes of nylon hoods which fit interchangeably on the instrument base. The 2X2 size is standard and is attached to its own permanent frame. Other hoods (2X2, 1X4, 1X5, 3X3) are used with frame pieces which must be assembled by the user.

*Throughout this manual the units CFM, cmh, and 1/s are used for simplicity. Note however that the Balometer actually reads in standard cubic feet per minute (SCFM), standard cubic meters per hour (scmh), or standard liters per second (std. 1/s). See the Specifications section for more information.

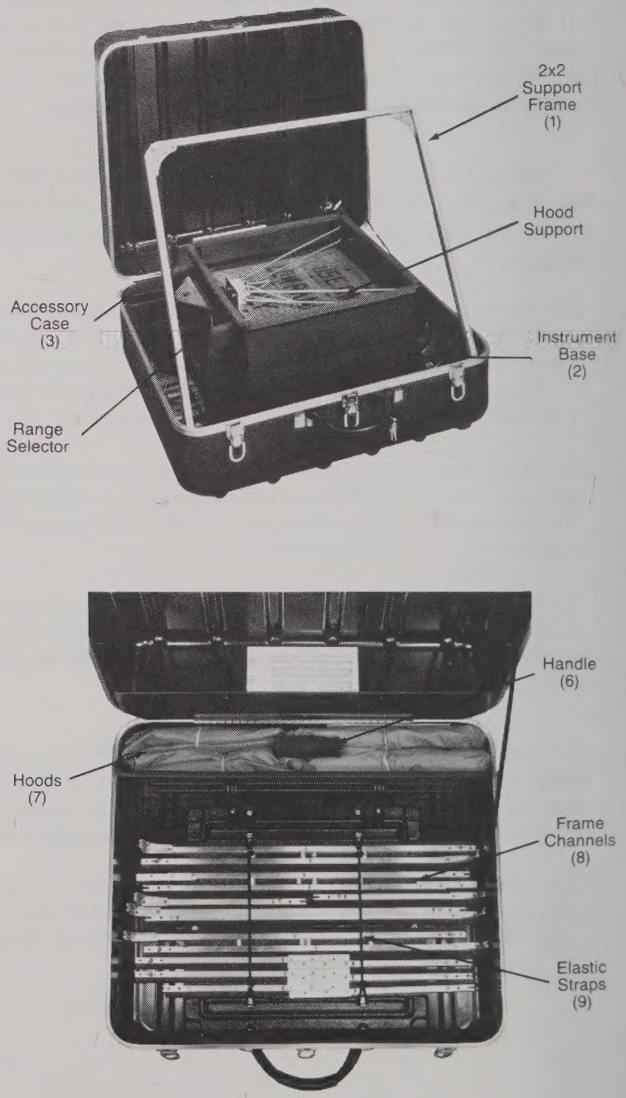


Figure 1. Unpacking

PREPARATION FOR USE

UNPACKING (See Figure 1)

BEFORE REMOVING ANY PARTS FROM THE CARRYING CASE THE ARRANGEMENT OF THE VARIOUS ITEMS SHOULD BE NOTED, SO THAT REPACKING CAN BE DONE EASILY.

The support frame (1) for the 2X2 hood must be removed from the case before the instrument base (2) can be lifted out. Depending on prior usage, the hood may already be attached to the frame and/or the instrument base. If the entire unit is to be lifted out as an assembly, caution must be exercised to assure that the pieces do not separate, since dropping the instrument may damage the Velometer.

At the rear of the carrying case is a built-in accessory case (3) with a hinged lid. Packed inside are four support dowels, anti-static solution, detachable handle (6), and any unmounted hoods (7). If the 2X4 or 3X3 hood size is part of your set, a package of four 8 1/2 inch dowels will also be found in the case.

If your instrument is equipped with more than one hood, the frame channels (8) needed to support other sizes will be found held to the bottom of the carrying case by elastic straps (9). See the parts list on page 13 to determine which channels are included for the hoods packed with your instrument.

ASSEMBLY

Frame Channels

The 2X2 size frame is permanently assembled (see Figure 2), and ready to use. If your unit includes only this size, go on to the paragraph on Hood Installation.

Figure 2. 2X2 Frame

Refer to Figures 3 through 6 to determine the frame channels needed to build any of the standard-sized frames. Select the pieces required for the frame size desired and assemble with the aid of the appropriate figure. Several sections (numbers 1, 3 and 4)* consist of a straight channel portion (each a different length) and a corner piece. This corner piece has an eyelet and slot arrangment which mates with a similar eyelet and slot at the end of the straight portion of the channel pieces (see Figure 7). These pieces can be slid together, and are self-locking by means of a retention spring. The arrangement forms a rugged frame which is additionally strengthened when the hood is attached.

The number 1 and 5 channels also have a wing nut at the straight end which will mate with an angle and studs on the ends of numbers 2, 5 and 6 to form the longer frame sides (see Figure 8).

*Each channel is labelled with its number for easy identification.

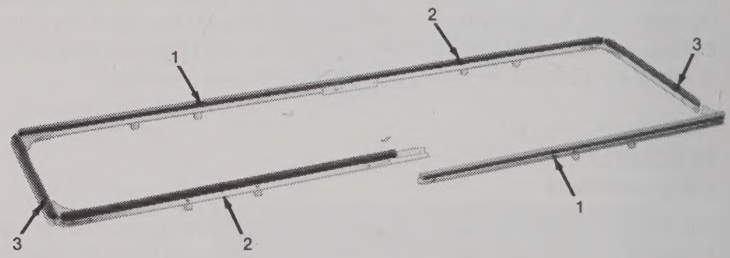


Figure 3. 1X4 Frame

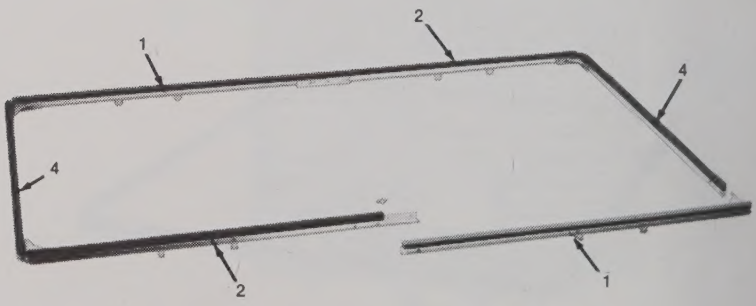


Figure 4. 2X4 Frame

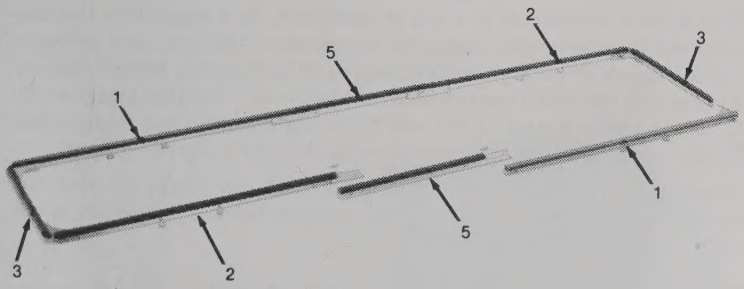


Figure 5. 1X5 Frame

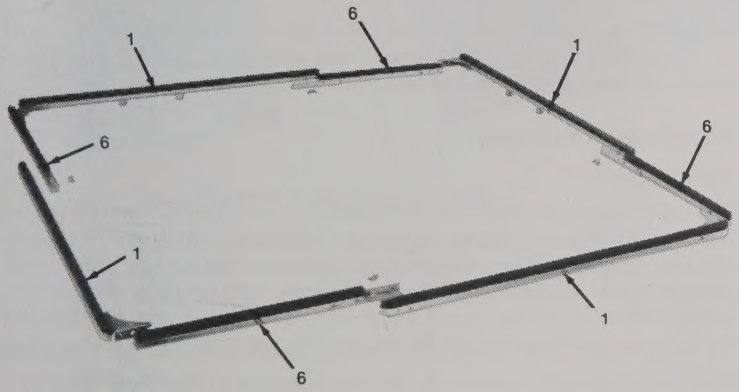


Figure 6. 3X3 Frame

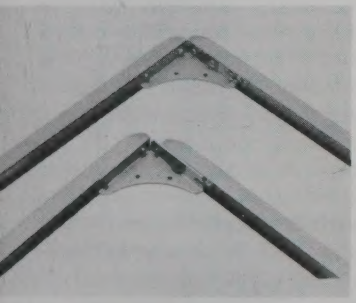


Figure 7. Frame Corner Assembly

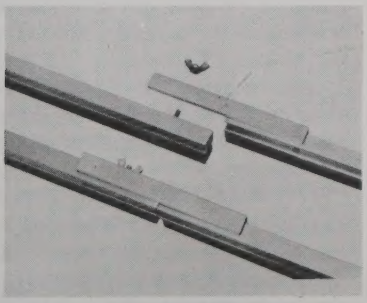


Figure 8. Frame Side Assembly

Hood Installation

Each hood is constructed in a trapezoidal shape, sewn together so that one open end forms a 14 inch square for attachment to the base, and the other forms a square or rectangle large enough to fit its matching frame assembly. Around each end of the hood an elastic cord ("shock" cord) has been sewn into the hood; this cord is of a size such that it can be pushed into the open side of the U-shaped channels of the frame and around the top of the base.

Attach the hood to the frame assembly first, and then to the base unit. By stretching around two corners the cord is slightly reduced in diameter and is easier to press into the channel.

NOTE: Always locate the hood seams at the corners of the frame and base.

After the first side is pressed into place each remaining side can be done in a similar fashion.

The hood can now be attached to the base in the same way. Do not attempt to set up the hood with the hood support and dowels until the hood has been completely attached to both the frame and the base.

Hood Support Assembly

Refer to Figure 9.

The hood support (1) should be positioned as shown. This is accomplished by swinging the long rods around so they project in a direction opposite to the short rods which hold the springs. In the corners of the base are tubes which contain a series of holes along one side. The ends of the long rods should be inserted in the bottom hole of each corner tube. If it is later found that the hood is not held as tautly as required the rods can be moved upward to compensate.

The support dowels (2) are now slid over the ends of the short rods. The aluminum tips on the dowels should be facing the top. If the 2X4 or 3X3 hood is to be used, a set of 8 inch long dowel extensions (3) must be added to either end of the long dowels.

The hood can now be raised and the ends of the dowels inserted in either the corner of the hood frame, or into one of the ferrules (cups) attached to the frame channels, depending on the hood and frame size. Rods go into corners on the 2X2, 2X4 and 3X3 frames, into the set of inner ferrules for the 1X5 frame, and in the outer ferrules for the 1X4 frame. Proper tautness has been achieved if the springs on the short rods of the hood support assembly are slightly (but not fully) compressed.

Detachable Handle

Depending on the work to be done, or for ease in carrying the Balometer from one location to another, it may be desirable to install the detachable handle. Simply screw it "hand tight" into its mating thread on the support plate above the range selector knob.

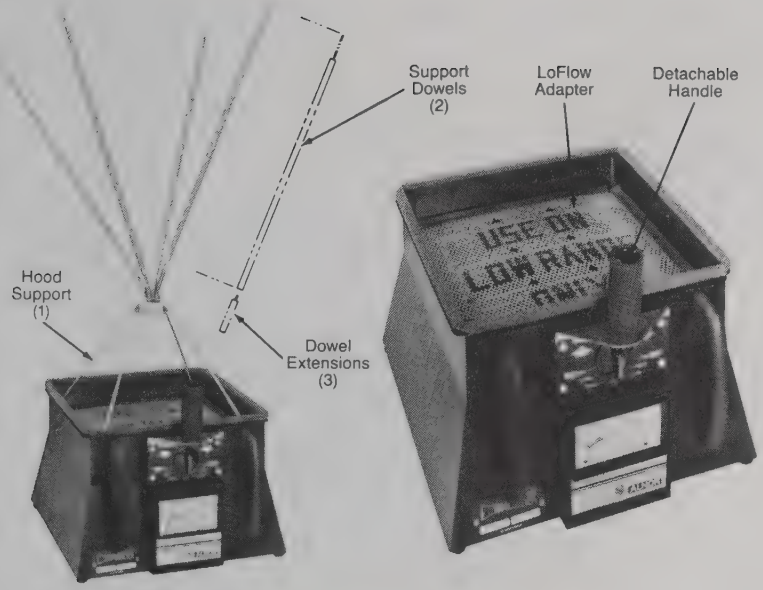


Figure 9. Instrument Assembly

NOTE: Make a habit of checking the tightness of this handle each time before use, to be sure it doesn't loosen while the instrument is being used to take readings, or while it is being carried from place to place.

See Figure 10 for ways that the permanent and detachable handles help in making measurements.

LoFlow Adapter

The LoFlow adapter (screen) can be used for measuring air volumes below 250 CFM, (400 cmh, 120 l/s), but it is strongly recommended that it be used only when measuring very low flows, below 125 CFM (200 cmh, 60 l/s). See the notes on the Specification page (p. 21) for the correction factor necessary when measuring exhaust flows between 150 and 250 CFM (250 to 400 cmh, 70 to 120 l/s).

The LoFlow adapter is inserted by carefully pushing it into position against the manifold on the side which the air will enter. If air will move through the hood TO the base of the instrument the adapter goes on the "hood" side of the manifold. The adapter should be in as close contact with the manifold as possible, and nowhere more than 1/8 inch away. Take care not to distort the manifold mounting in the process of installing or removing the adapter.

Do not forget to remove the adapter when measuring flow greater than 250 CFM. It is recommended that the adapter be used only when measuring very low flows (50 to 125 CFM). Note that it is strongly recommended the adapter be used only when measuring very low flows, up to 125 CFM (200 cmh, 60 l/s).

STEP BY STEP OPERATION

If the instrument has been stored at a temperature below 68 °F (20 °C) or above 86 °F (30 °C) it should be allowed to stabilize at room conditions (between 68 °F and 86 °F) in order to achieve specified accuracy.

1. Assemble the Balometer as described in the Preparation for Use section of this manual.

   If the Balometer will be carried between locations during use, the detachable handle should be mounted to its support plate on the base assembly. Until the Balometer is repacked in its carrying case the handle can remain mounted, whether or not it is used.

2. Check the Velometer for zero adjustment by placing the instrument away from any air flow, setting the range selector to the OFF position, and verifying that the meter reads zero. If necessary, use a small screwdriver to adjust the zero screw so that the pointer reads zero. Although the meter will typically continue to read zero (within one division) regardless of how the unit is held, it is best to zero the meter in the position in which it will be used.

3. Set the range selector to the highest reading in the desired direction, supply or return.

4. Bring the Balometer into contact with the perimeter of the diffuser or grill to be measured. See Figure 10 for guidance in how to hold the Balometer when taking measurements. To assure maximum accuracy, the foam gasket along the top of the frame must be firmly in contact with the surface all around the opening. Take care to ensure that your body or other material is not accidentally affecting the reading by blocking or diverting the air flow at either the air entry or exit sides.

   WHEN USING THE BALOMETER TO CHECK AIR FLOW AT CEILING DIFFUSERS MAKE CERTAIN THAT YOU CAN SAFELY RAISE AND HOLD THE UNIT WHILE MAKING THE MEASUREMENT. THIS IS ESPECIALLY IMPORTANT WHEN WORKING ON A LADDER. MAKE SURE THAT THE UNIT CAN NOT BE CAUGHT IN MOVING MACHINERY.

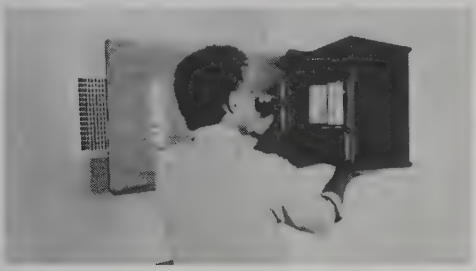
5. If the reading is found to be below the full scale of the next lower scale, the range selector may be switched to the next lower scale.

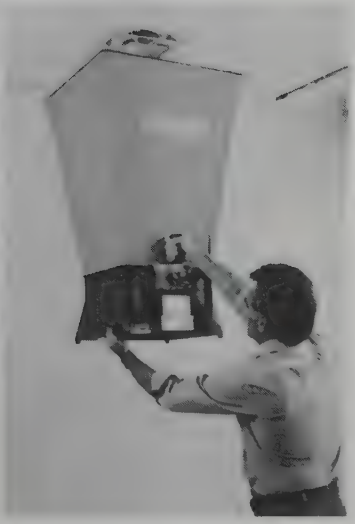
6. The reading from the Balometer is in standard cubic feet per minute (SCFM) or standard cubic meters per hour (scmh), or standard liters per second (std. l/s). To determine the true volume flow rate, multiply by the correction factor shown in Figure 13. The correction factor is based on the static pressure and air temperature at the manifold.

7. The additional system back pressure generated by the Balometer may affect the output of an individual diffuser. Depending on system design and balancing method, this may or may not be important. When proportionally balancing a system of similar outlets, this is not usually an important factor. If system design or other factors require adjustment, Figure 12 is included for your reference.

LOFLOW ADAPTER APPLICATION (Recommended measurement range 50 to 125 CFM)

The LoFlow screen must be placed on the side of the manifold against which the air pressure will be felt. It is strongly recommended that the selector be set to the highest range until a trial reading indicates the Velometer will not be damaged by an accidental over-range condition. If you find that the selector cannot be set to the lowest range it will be necessary to remove the adapter to ensure accurate measurement. The Balometer and adapter are calibrated at the factory for use on the lowest range only.





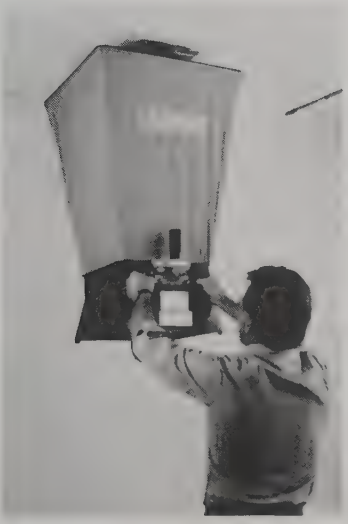


Figure 10. Holding Balometer for Measurements

REPACKING

Figure 1 may be helpful when repacking the instrument.

With the exception of the 2X2 hood and frame, hoods must be removed from their support frames, re-rolled and packed in the accessory case. All frames must be disassembled for storage in the carrying case, with the exception of the 2X2 size. Corner sections can be pulled apart when the retaining spring is pushed out of the hole into which it snaps at assembly. Put wing nuts back on their threads before storing, to avoid losing them.

All the frame pieces will fit within the formed plastic insert which is riveted to the case bottom. Use the positioning chart shown on the label attached to the inside of the carrying case to find the correct location for each piece. The formed insert is divided into two sections for convenient storage of parts when less than the maximum number of hoods are supplied with the instrument. Once all the parts are positioned they are held in place with the elastic straps.

Next dismount the dowels and pack them in the accessory case with the hoods.

The hood support is removed by slightly springing the ends of the long wires out of their mounting holes. After the LoFlow adapter is pressed (gently) into its storage position on top of the manifold, the hood support can be stowed. It will fit inside the base, by swinging the long rods to the same side as the short ones. All four long rod ends can then be inserted into holes in two adjacent corner tubes and the entire mechanism is then inside the base unit. Be careful however not to damage the manifold by pushing too hard when pressing the screen in place, or by allowing the short rods of the hood support to protrude through the screen.

Remove the detachable handle, if it has been mounted, and store it in the accessory case. The carrying case cannot be closed with this handle attached to the base.

The base assembly can now be placed in the carrying case, with the range selector and Velometer facing to the side (either side) of the case. The case will not close if the Velometer faces forward or to the rear.

The 2X2 frame (with hood attached, if convenient for further use) is the last item to be packed. The frame will be tilted, with the back of the frame resting on the top of the accessory case.

MAINTENANCE

NYLON TOPS

The tops will last longer if hand washed periodically in cool water with a mild detergent. When handling do not let the cloth come in contact with sharp corners or other objects which may "hole" or tear the material.

STATIC ELECTRICITY

It is common to encounter static electrical charges, especially in conditions of low humidity. Included with the Balometer when shipped from the factory is a container of anti-static solution which should be used if the Velometer will not hold a zero setting, or gives erratic readings. Using a soft lint-free cloth slightly moistened with anti-static solution, rub gently over the front of the Velometer case and window.

VELOMETER ZERO ADJUSTMENT (See Figure 11)

Check to see that the pointer of the Velometer is at zero each time the meter is put into service. The zero adjustment screw enables you to make an adjustment. With the range selector set to OFF, use a screwdriver to bring the pointer to zero. It should continue to read zero (within one division) regardless of how the Balometer is held.

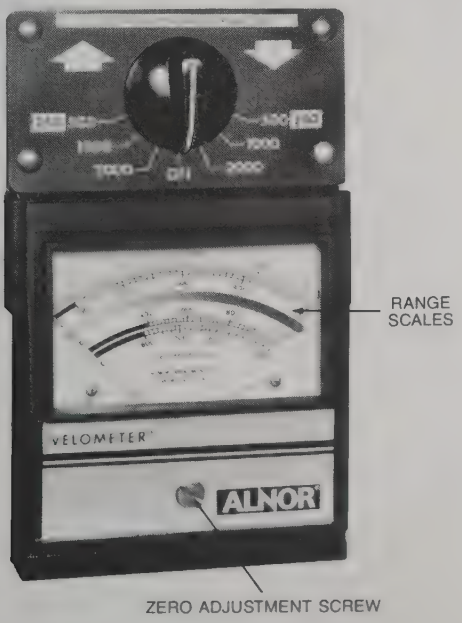


Figure 11. Velometer

MANIFOLD

The manifold should be checked before using to be certain that the sensing holes have not become clogged with dirt or dust particles. Inspect for leaks which may be caused by cracks, or by poor connection to the range selector through the short pieces of tubing. The manifold can be cleaned using mild detergent and warm water, without immersing the manifold in water. It is recommended that cleaning be done with the manifold in place, and with extreme care.

RECALIBRATION

Your Balometer may be returned to the factory for calibration, or if proper facilities are available may be calibrated using the procedures outlined in the Calibration section of this manual.

When shipping the Balometer for factory recalibration, pack it carefully, and follow the Instructions for Return in this manual.

LIST OF MODEL AND PART NUMBERS

MODEL NO.	PART NO.	DESCRIPTION
6461	634-593-100	Balometer Kit-CFM Scale, as shown below, with 2X2 Hood only
	634-593-101	Balometer Kit-cmh, as shown below, with 2X2 Hood only
	634-593-102	Balometer Kit-l/s, as shown below, with 2X2 Hood only
6463	634-593-110	Balometer Kit-CFM Scale, as shown below, with 2X2, 1X4, 2X4 Hoods
	634-593-111	Balometer Kit-cmh Scale, as shown below, with 2X2, 1X4, 2X4 Hoods
	634-593-112	Balometer Kit-l/s, as shown below, with 2X2, 1X4, 2X4 Hoods
6465	634-593-120	Balometer Kit-CMH Scale, as shown below, with 2X2, 1X4, 2X4, 1X5, 3X3 Hoods
	634-593-122	Balometer Kit-l/s, as shown below, with 2X2, 1X4, 2X4, 1X5, 3X3 Hoods
	634-593-115	Expansion Kit, to expand Model 6461 to Model 6463
	634-593-125	Expansion Kit, to expand Model 6463 to Model 6465

PARTS LIST

PART NO.	QTY.	DESCRIPTION
6461 BALOMETER WITH 2X2 HOOD		
534-513-045	1	Hood Support
534-513-016	4	Support Dowels
534-066-060	1	Carrying Case
534-513-031	1	2X2 Frame
534-513-034	1	2X2 Cloth Hood
534-066-059	1	Anti-static Solution
534-593-173	1	Handle
6463 BALOMETER WITH 3 HOOD SIZES		
Same as Model 6461, with the following—		
534-513-018	2	#1 Channel
534-513-017	2	#2 Channel
534-513-020	2	#3 Channel
534-513-021	2	#4 Channel
534-513-032	1	2X4 Cloth Hood
534-513-033	1	1X4 Cloth Hood
370-000-003	2	Elastic Strap
534-513-042	4	Dowel Extention
6465 BALOMETER WITH 5 HOOD SIZES		
Same as Model 6463, with the following—		
534-513-018	2	#1 Channel
534-513-040	2	#5 Channel
534-513-041	4	#6 Channel
534-513-035	1	1X5 Cloth Hood
534-513-036	1	3X3 Cloth Hood

PERFORMANCE CHECK

When checking the performance of the Balometer, first verify that the unit has been properly adjusted to zero. If the calibration is to be checked, a reference flow standard at least 5 times more accurate than the Balometer should be used. Flow standards that may be used for this purpose include orifice plates or laminar flow elements. These devices require accurate pressure and temperature reading instruments to measure actual flow volume.

If the Balometer is checked against a velocity standard such as a Pitot-static probe or thermal anemometer, the user should be aware that this may introduce errors. If a velocity standard is used, the average velocity must be obtained by taking a traverse.* The accuracy of this average reading is dependent on the flow uniformity, the number of readings in the average and the accuracy of the velocity reading instrument. This average velocity reading must then be multiplied by the area over which the traverse was taken. If this area is not accurately measured, additional errors in the final flow volume reading will result.

Finally, air flow instrumentation is often dependent on environmental conditions such as temperature, atmospheric pressure, humidity and even turbulence. These conditions can have very different effects on various instrument types. Caution must be exercised when making comparisons.

*A traverse is a set of velocity readings taken in a prescribed geometric pattern which will provide an overall velocity when averaged together.

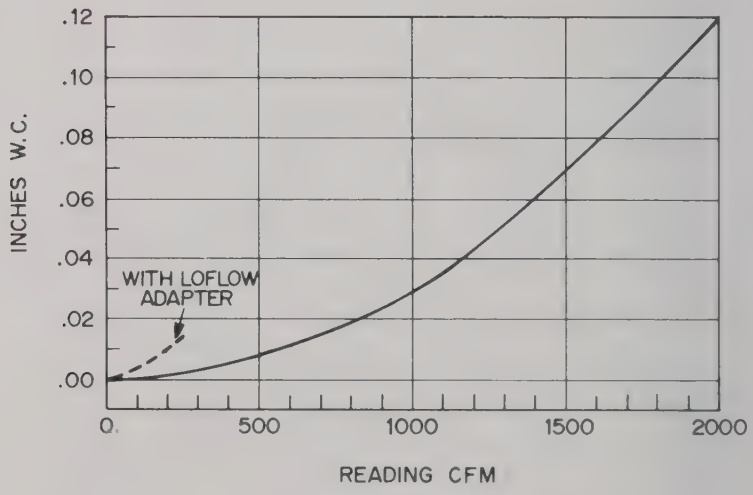


Figure 12. Backpressure Curve

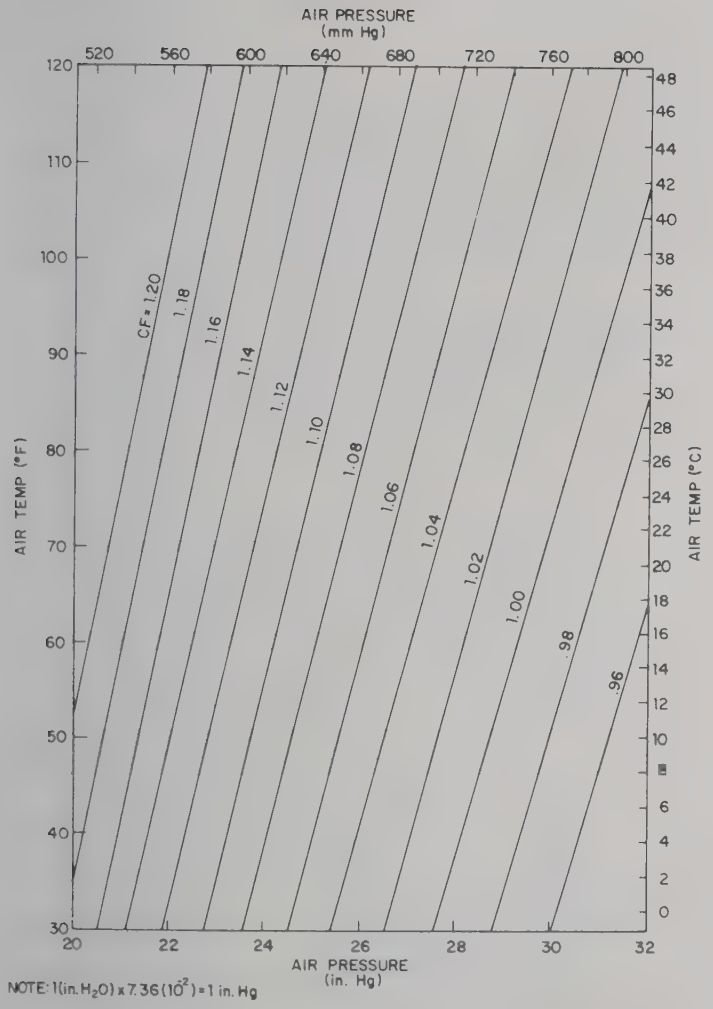


Figure 13. Correction Factors for Non-Standard Conditions

CALIBRATION PROCEDURE

GENERAL

The Balometer is easily calibrated assuming that the user or calibration facility has access to the proper equipment. Each range uses an easily set single screw adjustment for calibration. The procedure should however only be attempted by persons who have the proper equipment. Note that ANY ATTEMPT AT RECALIBRATION VOIDS ALL CALIBRATION CERTIFICATION PROVIDED WITH INSTRUMENT.

EQUIPMENT REQUIRED

Wind tunnel capable of providing controllable air flow in both supply and exhaust directions from 50 CFM to 2000 CFM (80 to 3400 cmh, 25 to 950 l/s); measurement standard for air volume over the same range; 2' x2' outlet air diffuser similar to ones typically in use; 1/16" hex adjustment device at least 2 1/2" long ("ball end" device is useful).

The wind tunnel and measurement standard should be controllable and accurate to within five times the accuracy of the scale being calibrated.

PREPARATION

1. Verify that there are no cracks in the manifold or leaks in the hoses connecting the manifold to the range selector.
2. Connect wind tunnel, measurement standard, diffuser and Balometer in such a way that the air which passes through the Balometer has also passed through the measurement standard and diffuser. Make sure there are no leaks in the system as any leaks will cause errors in calibration.

CALIBRATION

1. Set up Balometer with 2'x2' hood, and without LoFlow screen in place.
2. Set up Balometer on wind tunnel so that air volume through unit can be determined from measurement standard.
3. Turn off all air through Balometer and set range selector to OFF position.
4. Using zero adjust screw, set Velometer meter to 0 (see Figure 11).

5. Turn on wind tunnel and set to 400 SCFM (700 scmh, 200 l/s if metric unit).
6. Set range selector for low range in proper direction for air flow through the Balometer.
7. Insert hex adjustment tool into adjustment hole (See Figure 14), adjust until meter reading is the same as the wind tunnel setting, then remove adjustment tool.
8. Move range selector to mid range; set tunnel for 800 CFM (1400 cmh, 400 l/s); adjust as in step 7 until meter reading is the same as the wind tunnel setting; then remove adjustment tool.
9. Move range selector to high range; set tunnel or 1800 CFM (3000 cmh, 800 l/s); adjust as in step 7 until meter reading is the same as the wind tunnel setting; then remove adjustment tool.
10. Verify calibration against standard as required.
11. Modify set-up so that flow through Balometer is in opposite direction. Again make sure there are no leaks in the system.
12. Repeat steps 5 through 10 for air flow in this direction.

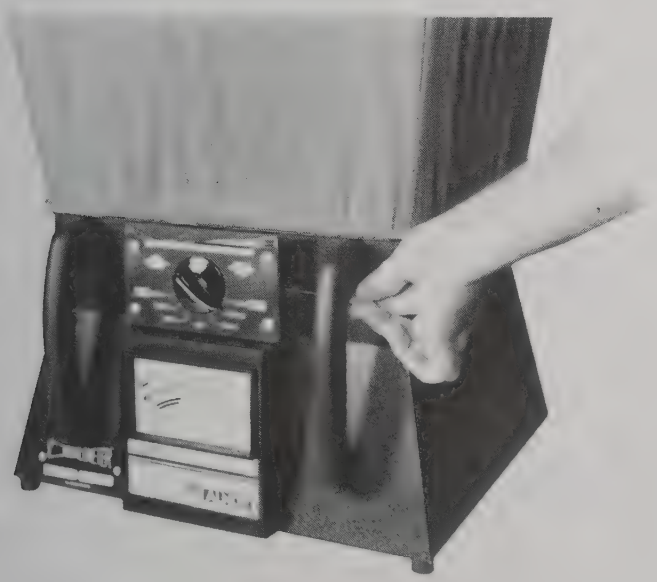


Figure 14. Calibration Adjustment

TROUBLESHOOTING GUIDE

SYMPTOM	POSSIBLE CAUSE AND CORRECTIVE ACTION
Meter not at zero before use.	Velometer not adjusted. Use zero adjustment screw.
Cannot zero meter.	Meter pointer not in balance. Return unit to factory for rebalance.
Meter reading lower than expected.	Hood frame not sealing properly around diffuser or grill. Press hood evenly against diffuser.
	Hood torn. Replace, or repair tear with duct tape or other non-porous material.
	Range selector not properly set. Make sure detent on switch is properly engaged.
	Manifold is cracked. Replace manifold.
	Manifold holes are plugged. Clean holes.
	Meter/range selector out of calibration. Recalibrate instrument.
	LoFlow adapter not installed when using lowest (blue) scale. Install adapter.
	LoFlow adapter not close enough to the manifold, or installed on wrong side of manifold. (See Preparation for Use section.)
Meter not indicating.	Range selector is switched to OFF. Position switch to correct range.
	Range selector incorrectly set. Position switch to correct range.
	Connection between manifold/range selector/meter is broken. Repair.
Meter reading higher than expected	Meter/range selector out of calibration. Recalibrate instrument.
	LoFlow adapter mistakenly left installed.

THEORY OF OPERATION

The Balometer is an adaptation of the Alnor Velometer system which allows this quality instrument to be used for measurement of air volume, by reading average velocity as the air moves through a cross-section of known constant dimension.

The Balometer consists of six major subassemblies which function as a system to provide accurate air volume measurements:

1. Air Collection System—All the air issuing from or entering a diffuser is collected through a cloth "hood" which is chosen to fit a specific diffuser at one end, and translates this variable size to a standard opening which is slightly larger than one foot square. The diffuser end of this hood is foam-edged to allow for a complete seal around the opening.

2. Instrument Base—The base, in addition to housing the range selector, manifold, and Velometer, provides the standard cross-section through which the air is passed. The bottom flared portion acts both as a secure footing for the instrument, and provides the exit for the captured air. This is also the entry point for air being exhausted from the room through the diffuser being measured.

3. Manifold—This is a grid which contains calibrated holes in a regular pattern spaced within the standard base opening. It is actually two grids back-to-back, with the pattern of holes in a separate network on each side. Air can therefore enter the manifold from either side and be discharged at the other. The amount of air which flows through the manifold is directly proportional to the average velocity of the air moving past the sensing holes. Therefore this velocity, which is moving through a known cross-sectional area, is proportional to the volume of air flow through the instrument.

4. Range Selector—By means of a single control the range selector provides for the measurement of air flow in either direction, and provides calibrated orifices for three ranges, which effectively triples the scale length of the meter. Accuracy of the measurement in either direction is assured by providing similar flow paths regardless of flow direction, and by separate calibration of each range, in each direction.

5. Velometer—Alnor's standard air measuring instrument is provided with a special scale graduated either in cubic feet per minute, cubic meters per hour, or liters per second. Because of the direct proportion cited earlier this velocity-reading instrument can be directly calibrated in volumetric terms.

6. LoFlow Adapter—This screen assembly makes use of the standard area and velocity principles mentioned above. The adapter reduces the effective area through which the air flows, causing a corresponding increase in velocity past the manifold. The screen blocks 50% of the standard opening, increasing the velocity to twice the original. This means, for example, that with the adapter a volume of 250 CFM will create the same velocity as 500 CFM without the adapter. A fourth scale has been provided on the Velometer to be used with the adapter, on the most sensitive range setting.

Note that the adapter provides higher sensitivity at low flow rates, but can more easily upset the system being measured at flow rates above 125 CFM (200 cmh, 60 l/s) because of additional back pressure. It is therefore suggested that measurements above this value be taken without the adapter.

SPECIFICATIONS

U.S. PATENT 4,548,076

ACCURACY (see Note 1)	±3% of full scale, except above 1300 CFM (2210 cmh, 610 l/s) on exhaust (flow from base to hood) which is ±4% of full scale
OPERATIONAL TEMPERATURE RANGE	32-122°F (0-50°C)
STORAGE TEMPERATURE	–40 to 140°F (–40 to 60°C)
SUPPLY AND EXHAUST RANGES	250, 500, 1000, 2000 Standard CFM (note 2) (400, 800, 1700, 3400 standard cmh) (note 2) (120, 240, 475, 950 standard l/s) (note 2)
MAXIMUM USABLE LIMIT	2000 CFM (3400 cmh, 960 l/s)
READ-OUT TIME	Approx. 4 seconds
STANDARD OPENINGS	2X2, 2X4, 1X4, 1X5, 3X3 (60X60 cm, 60X120 cm, 30X120 cm, 30X150 cm, 90X90 cm)
SCALE DIVISIONS	5 CFM from 0 to 250 CFM 10 CFM from 100 to 500 CFM 20 CFM from 400 to 1000 CFM 50 CFM from 800 to 2000 CFM 10 cmh from 0 to 420 cmh 10 cmh from 200 to 850 cmh 25 cmh from 700 to 1700 cmh 50 cmh from 1400 to 3400 cmh 5 l/s from 0 to 120 l/s 5 l/s from 50 to 240 l/s 10 l/s from 200 to 475 l/s 24 l/s from 400 to 960 l/s
DIMENSIONS	
Instrument	Height 40 in. (102 cm.) Width, Depth-variable depending on cloth hood size. Up to 5 ft. (153 cm.) wide, 3 ft. (92 cm.) deep at top opening Base 17"x17" (43 x 43 cm.)
Carrying Case	13"x26"x23" (HxWxD) 33x66x59 cm.

NOTES:

1. Corrections may be required in two situations, to achieve specified accuracy:
   - When using the LoFlow adapter to measure exhaust volume (air movement from base to vent) above 150 CFM (250 cubic meters/hr) multiply the reading by 1.02 to obtain measurement within tolerance.
   - Figure 9 can be used to determine the backpressure which the Balometer introduces. For systems without individually-controlled constant volume outlets, this correction may be factored into the system equation if desired.
2. Standard units are defined as volume referenced to standard conditions of atmospheric pressure and temperature - Temperature=70 F (20 C) Atmospheric Pressure=29.92"Hg (760 mm.Hg).

WARRANTY/REPAIR INFORMATION FORM

Contact Alnor Instrument Company before returning your Alnor Instrument to the factory. See INSTRUCTIONS FOR RETURN. Follow the procedure carefully as it will expedite processing. Failure to follow the procedure will/may cause return of unit unrepaired. Send your instrument to the factory transportation prepaid. To assure fast turn-around time, fill out this form with as much detail as possible and attach it to the instrument.

Instrument Model _____

Serial Number _____

Date of Purchase _____ Where Purchased _____

Describe malfunction _____

_____

_____

_____

Describe environment _____

_____

_____

_____

Return instrument to:

Name _____
(Your name or company)

Address _____

_____

Telephone _____

Address Correspondence to:

Name _____

Address _____

_____

Telephone _____

INSTRUCTIONS FOR RETURN

Damaged in Transit

All shipments are carefully examined by Alnor Quality Assurance and carefully packed for shipment. On receipt, if the shipping container appears to have been damaged during shipment, the instrument should be thoroughly inspected. The delivering carrier's papers should be signed noting the apparent damage.

If the instrument itself has been damaged, a claim should be promptly filed against the carrier by the customer. The selling agent will assist the customer by supplying all pertinent shipping information; however, the claim must be filed by the insured.

If the instrument is damaged beyond use, a new order should be placed with Alnor while awaiting reimbursement from the carrier for the damaged instrument.

Call Alnor directly for assistance if necessary.

Malfunction

Please follow these steps should you require factory service or repair of your Alnor Instrument:

1. Write or telephone the Alnor distributor in your country for cost of repair or recalibration and shipping instructions. Obtain a Purchase Order or purchase order number from your Purchasing Department showing instrument model number and cost of repair and/or recalibration. Securely package your instrument in a strong container surrounded by at least two inches (5 cm) of suitable shock-absorbing material. Include the Purchase Order, or Reference the Purchase Order on your packing slip.

2. In North America, telephone the Repair Department at the USA factory for cost of repair or recalibration, Authorization for Repair (AFR) number, and shipping instructions. On instruments being returned to the factory for recalibration, determine whether you prefer:

   --Certificate of Calibration, no data (states instrument checked and found to be within accuracy claimed and specifications listed in current literature).

   --Certificate of Traceability to National Institute of Standards and Technology (NIST, formerly NBS) with data (states instrument compared with factory standard traceable to NIST, lists of calibration data, i.e., "Standards reads..." and "This instrument reads...")

   Obtain a Purchase Order or purchase order number from your Purchasing Department showing instrument model number and cost of repair and/or recalibration. Securely package your instrument in a strong container surrounded by at least two inches (5 cm) of suitable shock-absorbing material. Include the Purchase Order, or Reference the Purchase Order on your packing slip. Mark the outside of the shipping container with the AFR Control number.

3. Forward the instrument prepaid. See back cover for factory addresses.

Please note that instruments received improperly marked or without an accompanying Purchase Order may be returned at your expense. Please also note that if an AFR# has been assigned, it will be cancelled if the instrument is not received by ALNOR within 60 days.

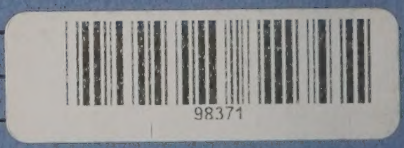
Equipment Log
MODEL _____

DATE OF PURCHASE _____

CALIBRATION RECORD

1._____	2._____	3._____
4._____	5._____	6._____
7._____	8._____	9._____
10._____	11._____	12._____

Notes: _____



ALNOR INSTRUMENT COMPANY
7555 N. LINDER AVE.
SKOKIE ILLINOIS USA 60077
TELEPHONE (708) 677-3500
TELEFAX (708) 677-3539

NOVEMBER 1991
Printed in USA

Manual #116-158-000 REV 13